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Maine Agricultural Experiment Station

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THE CHINCH BUG IN MAINE.

This bulletin contains an account of the Chinch Bug in Maine, together with a description of the insect, its habits and enemies, and methods by which it may be successfully fought.

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MAINE

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THE CHINCH BUG IN MAINE;

With Some Observations and experiments.

H. W. Britcher.

For nearly a century and a quarter the chinch bug, *Blissus leucopteris,* Say, has been recognized as a pest in the United States. In 1785 so much damage was done in North Carolina that in some districts wheat growing was abandoned. In 1809 another serious visitation occurred in that state and during a third destructive period in 1839 losses were also reported in South Carolina and Virginia. Between 1845 and 1850 injuries were reported from Illinois, Indiana and Wisconsin and during the few following years its destructive presence became known in other states. The loss due to its ravages in 1887 in Kentucky, Ohio, Indiana, Illinois, Minnesota, Iowa, Missouri and Kansas was estimated at $60,000,000, and it is further estimated that the total losses for the period from 1850 to 1898 were $330,000,000, chiefly in the above nine states. Although it occurs in largest numbers and does its chief injury in the states of the Mississippi Valley, its presence is known in every state of the Union except Oregon, Washington, Montana, Idaho, Nevada, Utah and Arizona. The crops, whose partial or total destruction has resulted in such enormous losses, include wheat, barley, rye, corn and several grasses.*

DESCRIPTION.

Fig. 11. CHINCH BUG. The short upright line shows natural length.

The chinch bug, which by its presence in vast hordes is able to cause such immense losses, is a near relative of the group of bugs popularly known as "stink bugs" and has, in common with them, the habit when disturbed of emitting a peculiar odor. When full grown it is about one-sixth of an inch long and one-twentieth of an inch broad. It is black in color, with a flat back upon which rest the wings, which are whitish in color with a black spot at about the middle of the external edge of each. In some individuals

*The first part of this bulletin is largely a compilation from Bulletin No. 15 of the Division of Entomology of the U. S. Department of Agriculture, entitled The Chinch Bug, by F. M. Webster.

the wings cover the whole abdomen while in others they are only long enough to cover from one-third to two-thirds of the back. These latter are known as the short-winged forms, while the former are spoken of as the long-winged forms. Both forms are covered on the body and legs with very fine hairs and are apparently alike in all respects except the size of the wings.

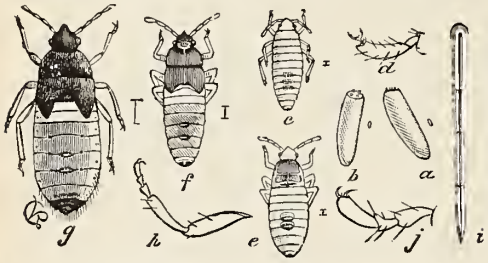

FIG. 12. CHINCH BUG, LARVA, PUPA AND EGG.

a and *b*, eggs; *c*, young larva; *d*, tarsus of same; *e*, larva after first molt; *f*, larva after second molt; *g*, pupa; *h*, leg; *i*, beak or tubular mouth; *j*, tarsus of mature bug. The short line at the right of each figure shows the natural length (after Riley).

The eggs are white in color, about one thirty-third of an inch long, and hatched in about two weeks after laying. The newly hatched larva is yellowish with a red spot on the back. Soon the whole body becomes reddish in color and after the first moult is bright vermillion, except the first two somites of the abdomen, which remain yellow, and the head which is dusky. After the second moult the head becomes still darker and the vermillion changes to duller red. After the third moult the head is brownish black, the abdomen grayish black and the legs blackish as in the adult stage, which is reached after the next moult. After the egg is laid about sixty days elapse before the adult stage is reached.

HABITS.

During the winter the bugs hibernate beneath such convenient material as loose bark and chips, dried leaves, corn shocks, the weeds of fence corners and similar places, and they may frequently be found, more or less closely crowded, low down among the stems of clumps of wild rushes and grasses, often working their way down between the stems and the soil. During the warm days of May and June they leave these quarters and become active, the long-winged individuals frequently flying some distance to fields favorable for egg laying. The eggs are deposited near or below the surface of the ground on the stems or roots of the food plants. The egg laying season extends over a period of about three weeks and each female may lay from three hundred to five hundred eggs. After hatching the young

usually remain below the surface of the ground, sucking the juices from the bases of the stems. When nearly mature they sometimes move higher up and so come to work above ground. If feeding in grain the whole brood, larvæ and adults, crawl off into nearby fields of corn or other food material when the grain is cut. They have been known to thus travel *en masse*, for over a quarter of a mile. There is also usually a migration from the feeding places to suitable places for hibernation during the warm days of early fall.

ENEMIES AND CHECKS.

It is reported that the chinch bug is devoured in considerable numbers by the common quail in some parts of the Central and Western States. Its other bird enemies include the prairie chicken, red-winged blackbird, catbird, brown thrush, meadow lark and house wren.

In Oklahoma Pekin ducks have been found to eat them readily. Frogs are also known to eat them, and a few insects, including lady-birds, one or two beetles, and two or three near relatives of the chinch bug itself also feed upon them to some extent.

Certain fungi have been found to attack chinch bugs normally and with one or two of these field experiments have been carried on rather extensively in some parts of the West, notably in Kansas and Indiana. The fungus has been grown in quantity in the laboratory under conditions favorable for its rapid multiplication and the spores have then been sent to localities in which chinch bugs were abundant and there sown among the bugs. In many instances the healthy bugs, in both larval and adult stages, have rapidly become infected with the fungus and have been speedily killed by its growth within them. However, the fungus requires for its own activity continued wet or damp weather, and appears to be practically worthless except under such conditions.

The weather itself is in all probability the most powerful factor in checking the increase of the chinch bug. The adult bug seems very little affected by moisture, but the larval insect, in all stages, more especially the earlier ones, are very soon killed by wet weather. If, therefore, frequent rains occur during the larval season of early summer, the bugs are considerably reduced in numbers and the amount of injury is much less than during dry seasons.

THE CHINCH BUG IN MAINE.

The chinch bug has been in Maine for some time, its presence being known in the grass lands about Fryeburg as much as thirty-five years ago.* During the past ten years it has been reported from Bridgton, Bethel, Jackman and Orono, at which last named place it has been found in a pasture near the village and also under leaves in woods on the University grounds. The region about Fryeburg is apparently the only locality in the State where the injury has been sufficient to attract general attention. Here it probably does slight damage every year without attracting notice. Occasionally there occurs a year or two especially favorable to the multiplication of the bug and then the damage wrought becomes conspicuous. In 1892 considerable injury was done and on the sixth of September a vial of the insects was sent to the Experiment Station for examination. They all proved to be in the pupa stage.

During the latter part of the summer of 1901 complaints were received at the Experiment Station that the chinch bugs were again causing an unusual amount of injury about Fryeburg. An examination of the conditions existing there during the latter part of September showed that the chief injury had been to timothy and hungarian grass, although corn and oats were in some instances attacked, as were also witch grass and barn grass. Timothy was completely killed over areas varying in size from a few square yards to others of several acres in extent. In some instances clover and witch grass had grown up in these spots. Barn grass growing among corn was completely killed and witch grass was killed to the ground, but grew up again as the bugs passed onward.

Although the damage for the year had ceased the bugs were easily found; in one case clustering in large numbers under the dead leaves, stems and other debris among the clover immediately bordering a spot on which the timothy had been killed; in another case crowding in and about the clumps of beard grass and sedge grass bordering a strip of hungarian grass. In such places as these and under dead grass and weeds about fence corners, under manure spread on the fields in the fall and not

* Report Maine Agricultural Experiment Station, 1892.

plowed under, under masses of dead leaves and rubbish of all sorts, the bugs pass the late fall and winter months, lying apparently dead during cold weather, but quickly coming into activity during the warm days of late spring.

REMEDIES.

As the chinch bug works chiefly among grass crops in Maine, many of the remedies employed against it in the West are practically worthless here. As the amount of injury during any year depends partially on the number of bugs which pass the preceding winter in safety, perhaps the best methods to use against them are such as are easily applicable during the winter months. The following methods, if applied before the ground is covered with snow, would probably prove reasonably effective.

1st. *Burning.* When there is considerable clover mixed with the timothy or hungarian grass, the bugs are very likely to winter over beneath the clover which borders for a few feet or yards immediately upon the spot where they have stopped injuring the grass. If such a strip be mowed closely by hand and allowed to dry for a few days it may be burned over and quantities of the bugs will be killed. If this burning be done after the ground is frozen, little, if any, injury will thereby be done to the grass. All rubbish such as dried grass and weeds at the edges of the fields, brush heaps, dead leaves, bark and chips, clumps of wild grasses, sedge grasses, etc., in nearby fields should be burned as completely as possible.

2d. *Spraying.* Chinch bugs are quickly killed by kerosene or kerosene emulsion, but it is essential that it be thoroughly applied. The bugs are so protected by the clover and grass that it is almost impossible to reach them by ordinary spraying. Sprinkling freely over the infested spots will usually be effectual although it may kill the grass also. Clumps of wild grass or sedges in which careful examination shows the bugs to be abundant might be sprinkled thoroughly with kerosene and then burned, thus killing the bugs which had crowded deep down among the bases of the plants, where the flames alone might not reach them.

3rd. *Plowing.* Where bugs are found in considerable numbers at the edges of spots which they have eaten over, they may be destroyed by plowing under the strip in which they are hiding.

Deep plowing, however, is necessary, followed by dragging and rolling in order to completely cover all vegetation and close up all holes or passages through which the bugs might make their way to the surface.

If used promptly and thoroughly, the two latter methods are also applicable when the bugs are found to be working during early summer, and are all the more effective then because the bugs do not scatter over the whole field but stay together in comparatively small areas or strips, and if they are promptly killed over such patches further injury for the season will be very much lessened.

OBSERVATIONS.

The winter of 1901-1902 was unusual in some of its features. Snow fell on the 14th of November and again on the 26th and also on December 4th, the total amount aggregating over two and a half feet. The maximum temperature did not rise much above freezing during this time and the snow lasted. On December 10th began two weeks of rainy weather during which over four inches of rain fell and the fields were washed bare of snow. During the last week of December the maximum day temperature varied from 29° to 50° and the minimum night temperature from 2° to 33°, and during this time eight inches of snow fell, followed a day later by one and a quarter inches of rain. The minimum temperature of 2° occurred the night before the rain, while the snow still remained on the ground. From December 16th to 23rd, while the ground was bare, the maximum day temperature had varied from 13° to 21° and the minimum night temperature from 5° below zero to 12° above.

During the first week of January two inches of snow fell, the minimum night temperature only once rose above 6° and the maximum day temperature only once above 22°, and high winds prevailed. Several snow falls occurred before January 20th, aggregating nearly a foot and a half. During the following week over two inches of rain fell, the temperature was higher and the ground again became bare. During February enough snow fell to keep the fields slightly covered, although it was badly drifted by the high winds which followed each snow fall.

About the 1st of November chinch bugs were found in considerable numbers in a pasture which was separated from a tim-

othy field by the width of the public road. The bugs were found beneath the debris collected in a brush heap by the road side, beneath the dead cedar twigs and leaves under one or two young cedars growing in the fence and in clumps of rushes (*Juncus*) growing in a moist situation in the the pasture. In the rushes the bugs were crowded among the bases of the stems, working their way even lower down than the surface of the ground. One clump about six inches in diameter was cut out an inch or so below the surface of the ground and picked to pieces and found to contain one hundred and fifty-six bugs. On December 14th ten bugs were taken from beneath a strip of bark lying on the ground and twenty-two from a *Juncus* clump six inches in diameter.

The melting snow and the rains of the last week in December flooded all except one edge of the *Juncus* patch. The sudden cold of the first days of January froze the water over this area three or four inches thick. The water beneath the ice then settled away, leaving an air space. The rain of January 21st and 22nd, together with the melting snow, filled this space and then overflowed through openings about the *Juncus* clumps. Through these openings chinch bugs were washed out and left stranded on the surface of the ice as the water flowed away. During the afternoon of January 23rd sixty-eight such bugs were picked up off the ice. All were making feeble leg movements, strong enough in some cases to cause very slow progression. Fifty-three of these bugs were short-winged. (See Experiment 6.) On the morning of the same day thirty-two long-winged forms and two short-winged forms were taken from beneath a flat log frozen to the ground. All were thickly covered with frost crystals and made no responsive movements when picked up, but all became active after being in the laboratory a few moments. (See Experiment 5.)

On the 27th of January rain washed more bugs out onto the ice. Many of these were frozen into the ice during the two following days, during which the maximum temperature did not rise above 13° On January 29th six of these frozen bugs, all short-winged, were chopped out of the ice and slowly thawed out. None of them gave any signs of life. On the same day ten long-winged and one short-winged forms were taken from among leaves beneath a loosely attached board. When thawed

out only three long-winged forms failed to show signs of life. Six were able to walk about actively, while two were unable to walk but could move their legs feebly.

On February 14th two clumps of *Juncus* were chopped out. The first was three inches in diameter and contained fifty long-winged bugs and ten short-winged ones. The second clump was six inches in diameter and contained forty-two long-winged forms and eight short-winged ones.

On April 5th, after three weeks of mild and rainy weather, thirty-six long-winged and twenty-nine short-winged forms were taken from the under side of a piece of board two feet long and five inches wide. They were clustered in groups and moved off readily when disturbed. A few bugs were also found in clumps of *Juncus* and these were less active than those beneath the board.

On October 1st, 1902, the chinch bugs were again found in winter quarters in the same locality as during the fall of 1901. Eighteen short-winged and two long-winged forms were shaken out of a piece of *Juncus* clump. On October 15th four hundred and twenty-nine short-winged and forty-four long-winged forms were taken from beneath cedar debris and on October 31st fifty-eight short-winged and fourteen long-winged forms were taken from the same locality.

Thus, of the five hundred and sixty-five bugs collected during October, 1902, only sixty were long-winged.

Of the seven hundred and sixty-three bugs collected during the winter of 1901-1902 two hundred and forty-six were short-winged, three hundred and thirty-nine were long-winged and the remaining one hundred and eighty-eight were not examined as to length of wings.

The odor of the bugs collected and experimented with during October seemed much stronger and more persistent than that of bugs collected and experimented with during the winter.

EXPERIMENTS.

In order to test the powers of the chinch bug to withstand severe and unusual conditions, the following experiments were made:

Experiment 1. Twenty long-winged and five short-winged forms were frozen in an open box from January 17th to 23rd when they were thawed out by a cold rain. None of them showed any signs of life.

Experiment 2. Seven long-winged and five short-winged forms were frozen in a block of ice from January 17th to 23rd. No signs of life were shown after thawing out.

Experiment 3. Fifteen long-winged and eight short-winged forms were packed in snow and frozen from January 18th to 23rd. After thawing out two long-winged and four short-winged forms walked about actively; the rest did not revive.

Experiment 4. Ten long-winged and six short-winged forms were frozen in an open box for fifteen hours. Upon thawing out two gave no signs of life. After being kept for nine hours at a temperature of 65° the fourteen surviving bugs were refrozen for fifteen hours and then thawed out, when five long-winged and three short-winged forms revived. After nine hours at a temperature of 65° they were refrozen for fifteen hours, during which time the minimum temperature sank to 16° below zero. When thawed out all revived, but during the following nine hours at 65° temperature the three short-winged forms and two of the long-winged ones died. The remaining three long-winged forms were then again refrozen for fifteen hours, after which none revived.

Experiment 5. Thirty-two long-winged and two short-winged forms taken from beneath a log on January 23rd were kept at the ordinary temperature of the laboratory in a covered pasteboard box. Several thicknesses of filter paper were laid on the bottom of the box and well moistened twice daily for eight days, when only two bugs remained alive.

Experiment 6. Fifty-three short-winged and fifteen long-winged bugs picked up from the ice on January 23rd were kept at laboratory temperature in a covered box with filter paper moistened twice daily for eight days. Nineteen long-winged and eight short-winged forms were alive at the end of that time. These twenty-seven were continued at the same temperature but without moisture for seven days longer when five short-winged forms still remained alive.

Experiment 7. Three long-winged forms were frozen for twenty hours in a dry glass tube. None revived when thawed out.

Experiment 8. Three long-winged forms were frozen for twenty hours in a block of ice. None revived after being thawed out.

Experiment 9. Five long-winged and three short-winged bugs were frozen between sheets of wet filter paper for seventeen hours. Four long-winged and one short-winged forms revived when thawed out.

Experiment 10. Seven long-winged and one short-winged forms were frozen in a block of ice for seventeen hours. None revived when thawed out.

Experiment 11. Five long-winged and two short-winged bugs were frozen in a dry glass tube for seventeen hours. Three long-winged forms revived after thawing out.

The minimum temperature for experiments 7 and 8 was 2° and the maximum was 16°. For experiments 9, 10 and 11 the minimum was 4° and the maximum 10°.

Experiment 12. A small clump of *Juncus* was cut from the ground, wrapped in paper and exposed for twenty-five days on the north side of a building where it received no sun rays. It was then picked to pieces and sixteen bugs were found, of which eleven short-winged ones were dead, and three short-winged ones and two long-winged ones were alive. During this exposure the minimum temperature was 15° below zero and the maximum was 45°.

Experiment 13. A clump of *Juncus* was cut out of the ground, wrapped in paper and exposed on the north side of the building for forty days. when it was picked to pieces and found to contain fourteen long-winged and thirty-two short-winged bugs which were dead, and nine long-winged and seven short-winged bugs which were alive. The minimum temperature for the forty days was 15° below zero and the maximum was 52°.

Experiment 14. Five long-winged and four short-winged bugs were completely submerged in water for three hours, after which all revived, the short-winged forms becoming active first. They were kept dry for seven hours and then again completely submerged for eleven hours. All revived, were kept dry for twelve hours and again completely submerged for seventeen hours. All revived except one short-winged individual. After being dry for twenty-four hours the remaining eight were submerged for twenty-five hours, after which one long-winged and one short-winged form failed to revive. Another short-winged form died during the day. The remaining five were submerged for thirty hours, after which they were kept dry for eighteen

hours, at the end of which time only the one short-winged individual was alive.

Experiment 15. Eleven long-winged and three short-winged bugs were completely submerged for twenty-five hours. All revived in from twenty to seventy-five minutes. After being dry for eighteen hours they were again submerged for thirty hours, after which none revived in less than an hour and after being dry for eighteen hours three long-winged and two short-winged forms were dead. The remaining nine were then submerged for fifty hours after which four long-winged forms revived within ninety minutes. Three of these were still able to move about at the end of eighteen hours.

Experiment 16. Four long-winged and four short-winged bugs were submerged for twenty-seven hours. All revived, but at the end of eighteen hours one short-winged individual was dead. At the end of fifty hours longer the remainder were all found to be dead.

Experiment 17. Six long-winged and ten short-winged bugs were submerged for fifty hours, after which all revived except one of each form. After being dry for eighteen hours, all except one long-winged and two short-winged forms were walking about actively.

Experiment 18. Twenty long-winged and five short-winged bugs were submerged for seventy-five hours. There were no signs of reviving at the end of three hours, but at the end of twenty hours twelve long-winged and four short-winged forms were moving their legs, one of each form being able to walk about.

Experiment 19. Thirteen long-winged and two short-winged bugs were kept for seventy-five hours in a tightly corked two-dram vial. At the end of forty-eight hours all were inactive, but all revived within two hours after the end of the test.

Experiment 20. Eight long-winged and three short-winged bugs were frozen in a dry glass tube for sixteen hours. None revived in less than two hours, but at the end of six hours all but one of each form had revived, but none were able to walk about.

Experiment 21. Four long-winged and seventeen short-winged bugs were submerged for twenty-six hours after which all but one revived in from one to four hours.

Experiment 22. Five long-winged and fifteen short-winged bugs were submerged for forty-eight hours after which nine short-winged forms revived in from two and a half to six hours. Only two however were able to walk about.

Experiment 23. Eight long-winged and twenty-two short-winged bugs were submerged for sixty-eight hours. After being dry for eight hours only one long-winged and two short-winged forms had revived and these were unable to make any but very feeble movements.

Experiment 24. Fifteen short-winged bugs were placed in a tightly closed two-dram vial. In six hours they had ceased all movements and lay as if dead. After twenty-four hours five were taken out, but failed to revive at the end of three hours. After forty-eight hours the other ten were taken out. They showed no signs of reviving at the end of eight hours.

Experiment 25. Fourteen long-winged bugs were placed in a tightly closed two-dram vial. At the end of thirty hours all were active. At the end of fifty hours all were still able to move about feebly. At the end of seventy-two hours all but one were still able to move their legs feebly but not able to walk about. They were then taken from the vial and after half an hour all were able to walk about.

Experiments 1-20 were performed during January and February, 1902, and experiments 21-25 during October, 1902.

CONCLUSIONS.

From the foregoing observations and experiments the following conclusions seem reasonable:

The hibernation of the chinch bug is not a period of prolonged or continuous torpidity, but a period during which the torpidity may be broken by warm weather, when the bug becomes capable of active movements.

Complete submersion in water, even for a considerable period is not necessarily fatal.

Freezing while submerged in water is almost surely fatal.

Freezing while exposed to a dry atmosphere is generally fatal.

Freezing in a moisture laden atmosphere is only occasionally fatal.

The Station has issued the following special publications which will be sent on application:

How to Fight Apple Enemies.
How to Fight Cucumber Enemies.
How to Fight Potato Enemies.
Oat Smut and its Prevention.